

Psychology essays - adult development



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Adult development: critically evaluate the various explanatory models that have been proposed to explain cognitive ageing. relate this to models of ageing as a general process.

In examining the changes that occur to the brain over a lifetime it has been found that there are predictable decreases in certain cognitive abilities. These can be grouped into three categories: crystallised intelligence, memory and cognitive speed. Crystallised intelligence refers to the accumulated knowledge of a person that is normally assessed by vocabulary tests or other tests of knowledge. Memory is commonly and usefully split into long and short term. Cognitive speed is examined with tests that are timed, such as the digit symbol substitution from Wechsler Adult Intelligence Scale. In a review of the data from many longitudinal studies of these measures Christensen (2001) describes the overall results. Crystallised abilities have been shown to increase into the 60s and 70s, while memory and cognitive speed decline continuously in a linear fashion from the age of 30 or so. What process, then, is causing this decline and how can it be explained?

It is when taking a closer look at exactly which cognitive functions are declining that the complexity of the picture and the theoretical challenge starts to emerge. For example while both cued recall and free recall performance declines with age, there has been little decline shown for picture recognition, implicit memory or measures of verbal ability. Early studies such as Craik & Byrd (1982) concentrated on working memory and the idea that it is the capacity of this part of short-term memory that is decreasing and causing cognitive deficits. Working memory is normally

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measured by using reading span or computation span tests. In this test, participants are asked to remember one number while they perform another calculation. The number of items that can be remembered in sequence is indicative of the capacity of their working memory. Another early theory concentrates on the inhibitory powers of the brain and is also related to a part of the functioning of working memory. Inhibition refers to the brains' ability to block out stimuli that are not relevant to the task at hand. The hypothesis is that it is this ability that declines with age, and is the fundamental decrease in cognitive functioning seen with ageing. Hasher, Stoltzfus, Zacks & Rypma (1991) found that while young adults show a negative priming effect and older adults do not. From their data they hypothesise that older adults actually show an impairment in both attention and retrieval which results from this failure of inhibition.

The working memory theories, while providing a good explanation of some of the specific problems of age, is not an easily generalisable theory. In fact it does not fit neatly with a generalised theory of ageing which posits a gradual overall decline in integrity and function. More in line with that type of theory, Spearman (1904) was perhaps the first to notice that there was a correlation between the results of the many different types of test applied. It is in this general type of finding that one class of theory has its roots. The processing speed theory postulates that the changes in cognitive abilities are primarily the result of an overall cognitive slow-down that occurs with ageing.

Salthouse (1996) describes this as a decrease in the basic mental operations such as encoding, rehearsal, retrieval and so on. For example when relevant information is required by different parts of the brain there will be a delay in

retrieving it. This kind of theory is very closely related to a more general model of the ageing process. There are a number of studies that show strong support for this hypothesis. When examining paired associations, cued recall and a number of other factors, statistical control for the speed of information processing reduces the correlation between age and the related deficits. This infers that it is this speed of processing that is a significant part of the changes.

The processing speed theory is, however, open to a number of criticisms. Zimprich & Martin (2002) point out that the research used in examining the processing speed theory tends to be cross-sectional. While this type of research can yield useful results it tends to explain age changes rather than age differences. There is also more than a suggestion that people age differently, something this type of research does not generally examine. This might be especially important in that group of ageing adults that is suffering from some neurological condition – this would be a confounding variable. Zimprich & Martin (2002) tested the speed of processing theory using a longitudinal study, reporting that other studies have shown a significant reduction in the explanatory power of the theory when it is tested in this fashion. In replicating previous studies, they used the concept of ‘fluid intelligence’ – this is the type of reasoning ability that does not rely on previous experience but on immediate cognitive abilities – to see if the speed processing theory best explains the data. In fact a much lower correlation was found in this study than had been found in the cross-sectional studies. This study does not provide strong support for the processing speed theory in that it does not show that an overall cognitive slowdown is causing a

decrease on tests of fluid intelligence. It seems likely from these results that it is not appropriate to view cognitive ageing in terms of a single factor.

An alternative conception of how cognitive function changes with age has been to look at sensory functions such as visual and auditory acuity.

Lindenberger & Baltes (1994) found that simple measures of both these sensory functions accounted for a large amount of the variation in intellectual functioning. This approach uses a wide variety of cognitive tests to assess intellectual functioning. Baltes & Lindenberger (1997) argue that their results show that intellectual functioning was *completely mediated* by the changes in auditory and visual acuity. They account for their findings using three different theories: the sensory deprivation hypothesis, an ageing affected increase in cognitive load, and finally a 'common cause' hypothesis. It was the common cause hypothesis that was best supported by their data. This was because the size of the relationship between sensory acuities and cognitive abilities remained largely the same, no matter which of the different types of cognitive test was used. Baltes & Lindenberger (1997) attempted to replicate their earlier findings by increasing the size of their sample as well as increasing the age range of their participants to those between 25 and 69 years old. They found that their earlier work was confirmed and that the same connections between sensory acuity and intellectual abilities were present in their findings. What this then suggests is that this underlying mechanism for change in both cognitive and sensory abilities has a common cause. The authors of this study admit that their results doesn't really distinguish between the three different types of causes that they propose. What they do assert is that there are other lines of

evidence that also support this theory. Lindenberger & Baltes (1994) found that there was a connection between balance and gait with intellectual abilities. They also found in this earlier study that there was still a connection between these factors even when older adults with vision or hearing problems were excluded. Baltes & Lindenberger (1997) point out that with the lower age range of participants it is much less likely that they will be suffering from visual or auditory problems.

The concentration of this line of research on sensory acuity is perhaps most in line with more general theories of ageing which tend to stress the overall decline of functions in the body with age. These lines of research show an increasing convergence of the cognitive and non-cognitive factors as having a common cause. Salthous, Fristoe, McGuthry & Hambrick (1998) re-examined previously published data along with new information that covered both cognitive and non-cognitive variables. They point out that some of the previous correlations found between these factors and age may be an artefact of the statistical process. They attempted to control for these and still found that the majority of the measures examined showed a shared variance with age. However when controlling for age, the non-cognitive variables show a significantly lower correlation. This would suggest cracks opening up in the common cause hypothesis as results that show a difference between cognitive and non-cognitive variables do not tend to support it.

Christensen, Mackinnon, Korten & Jorm (2001) built on Baltes & Lindenberger work as well as Salthouse et al.'s (1998) work in their study which included a wider range of variables. They took the same broader approach by using the <https://assignbuster.com/psychology-essays-adult-development/>

' common cause hypothesis' as their starting point. In their formulation cognitive speed is considered a ' cognitive primitive' like sensory functioning. The research has shown a correlation between these factors and other, non-cognitive, factors such as physical strength and blood pressure. What this study aimed to find out, using ' multiple indicator, multiple cause model' (MIMIC) was whether all of these factors had a common cause. How this study differed to previous research was that it included a wider range of variables such as gender, education and a particular genotype that has been shown to be important in ageing. The results showed there was some significant associations between almost all the factors measured and a ' common cause'. Significantly this was also found over a wide range of age-groups. In addition, for grip strength and visual acuity a greater association with age, beyond that posited by the ' common cause' factor. The authors argue that the use of the MIMIC model reduces the susceptibility of the ' common cause' hypothesis to the criticism of circularity. This is one of the commonest criticisms of the theory and rest on one of the most basic problems with correlational research. Just because an association is found using statistical techniques, it doesn't mean that there is a causative link between the factors - merely that they are associated. By including a measure of intelligence, which was not associated with the common cause factor, the suggestion is that there is no relation with general intelligence.

An idea fundamental to much of the research in this area is that there is a decline in cognitive function with age that is somehow related to health. The problem has been in determining how these linkages work. As age increases, it is generally accepted that many measures of health decline. An obvious

hypothesis, then, is that cognitive declines are directly related to health status. Earles & Salthouse (1995) examined how age, self-reported health and speed were related. They found mixed results that suggested that health did mediate some but not all of the relationship between speed and age. The question this raises then is whether health effects act directly on memory performance or indirectly through being a partial cause of an overall slower processing. What they found was that the age-differences that were found in memory abilities were mediated by perceptual speed. This is a similar kind of finding to earlier studies like Hasher, Stoltzfus, Zacks & Rypma (1991) that hypothesised an inhibitory mechanism for the impairment of cognitive abilities. It is also similar again to the processing speed theory.

From the studies discussed so far it is clear that a range of factors are important in age related deficits of cognitive function, primarily these are working memory and some notion of processing speed. Park, Smith, Lautenschlager, Earles, Frieske, Zwahr & Gaines (1996) examined how these two factors were interrelated by using a battery of cognitive tests that measured these constructs. They found that both working memory and, to a greater extent, processing speed were important in explaining age-related variance in memory performance. Interestingly, as the memory tasks required more effort, so the importance of working memory increased. Working memory also seemed to be important in its own right, rather than being a subset of overall speed. This again backed up previous research and also showed that working memory and speed of processing are independently important. It can also be seen as providing particularly strong evidence for the speed processing theory, as this was shown to explain a

significant proportion of the variance with memory factors taken out of the equation.

Most of the studies reported here are of a correlational nature which is often open to causative criticisms, however a new line of studies in neuroimaging is starting to produce interesting findings about what is happening inside the brain as a result of ageing. Reuter-Lorenz (2002) summarises the four key findings coming from these studies. (1) Specific areas of under-activation of the brain have been found in older adults when compared to younger adults. (2) While matching the behaviour of older and younger adults, quite different patterns of activation are seen across the brain. (3) Younger adults show unilateral brain activity at a task, while older adults show bilateral activity at the same task. (4) There is evidence that the brains of older adults are involved in compensatory strategies through their different patterns of activation from younger adults. These kind of findings have also spurred the production of the first computation theories of cognitive ageing. These are starting to posit different models of the causes of the cognitive deficits that have been measured. For example Meyer, Glass, Mueller, Seymour & Kieras (2001) explain a model of brain function called the executive process interactive control model. This introduces the idea that performance deficits may in fact be a result of more conservative and inefficient working of their computational model rather than having biological causes. This type of model still has at its heart a very similar approach to the processing speed theory and also takes into account many of the different findings discussed here, such as the degradation of sensory acuity.

One theory coming out of the brain-imaging studies is that of dedifferentiation. In developmental terms, as a human becomes an adult, there is a trend towards the increasing specialisation of neural functioning. The dedifferentiation theory states that this process may be reversed in old age, so that older adults are recruiting more varied parts of the brain to carry out the same brain functions. This kind of theory explains some of the findings coming from neuro-imaging studies that show more widespread brain activation in older adults. Whether this is the cause of cognitive deficits or the result of an attempt to compensate has yet to be determined.

From many of the studies discussed it seems clear that processing speed is an important factor in cognitive ageing. This hypothesis is directly analogous to the general models of ageing which show for example that brain mass decreases by 10% between the ages of 30 and 90 and the body suffers a gradual overall slowdown in function and abilities. The challenge for this area of psychology is the huge variety of different measures being employed and the difficulty of relating them. Correlational studies have the tendency to get stuck in circular arguments where it is difficult to differentiate causation. In addition, longitudinal studies are not showing the same strength of results as cross-sectional studies. Neuro-imaging studies, however, have the advantage that it is possible to see what function the brain is performing and how it differs with age. Perhaps these kind of studies also shine a beacon of hope for our population as its average age continues to increase: the brain attempts to compensate for the ageing process to allow us to continue functioning for longer.

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